

WHAT IS CLAIMED IS:

1. A vertical cavity surface emitting laser, comprising:
 - an indium-based semiconductor alloy substrate;
 - a first mirror stack over the substrate;
 - an active region having a plurality of quantum wells over the first mirror stack;
 - a tunnel junction over the active region, the tunnel junction including a p-doped pseudomorphically strained layer of a compound selected from the group consisting of Al-rich InAlAs, AlAs, Ga-rich InGaAs, GaAs and combinations thereof; and
 - a second mirror stack over the tunnel junction.
2. A vertical cavity surface emitting laser according to claim 1, wherein the tunnel junction further includes a Zn doped layer.
3. A vertical cavity surface emitting laser according to claim 1, further including an n-type spacer adjacent the active region, and wherein the first mirror stack is an n-type DBR.
4. A vertical cavity surface emitting laser according to claim 1, further including an p-type spacer adjacent the tunnel junction, and wherein the second mirror stack is an n-type DBR.

5. A vertical cavity surface emitting laser according to claim 1, further including:
an n-type bottom spacer adjacent the active region, and wherein the first mirror stack
is an n-type DBR; and

an p-type top spacer adjacent the tunnel junction,
wherein the first and second mirror stacks are each an n-type DBR.
6. A vertical cavity surface emitting laser according to claim 1, wherein the p-doped pseudomorphically strained layer is grown by MOCVD or MBE.
7. A vertical cavity surface emitting laser according to claim 6, wherein the p-doped pseudomorphically strained layer is doped with carbon with a concentration greater than $1 \times 10^{19} \text{ cm}^{-3}$.
8. A vertical cavity surface emitting laser according to claim 1, wherein the active region includes one of InGaAsP and AlInGaAs.
9. A vertical cavity surface emitting laser according to claim 1, wherein the tunnel junction further includes an n-doped layer of a compound in the group consisting of InP, AlInAs, AlInGaAs, or InGaAsP.
10. A vertical cavity surface emitting laser according to claim 1, wherein the first and second mirror stacks are lower and upper mirror stacks, respectively.

11. A tunnel junction having a p-doped pseudomorphically strained layer, wherein the p-doped pseudomorphically strained layer includes a compound in the group consisting of Al-rich InAlAs, AlAs, Ga-rich InGaAs, GaAs and combinations thereof.

12. A tunnel junction according to claim 11, further including a Zn doped layer.

13. A tunnel junction according to claim 11, wherein the p-doped pseudomorphically strained layer is doped with carbon with a concentration greater than $1 \times 10^{19} \text{ cm}^{-3}$.

14. A tunnel junction according to claim 11, further including an n-doped layer of a compound in the group consisting of InP, AlInAs, AlInGaAs, and InGaAsP.

15. A tunnel junction according to claim 14, wherein the n-doped layer is doped with a concentration greater than $5 \times 10^{19} \text{ cm}^{-3}$.

16. A tunnel junction according to claim 14, wherein the n-doped layer is less than about 10 nanometers thick.

17. A tunnel junction according to claim 14, wherein the n-doped layer is doped with a concentration greater than $5 \times 10^{19} \text{ cm}^{-3}$ and the n-doped layer is less than about 10 nanometers thick.